2017

FINDING THE LINK BETWEEN SOCIAL CONNECTIVITY AND DIETARY INTAKE AMONG RURAL ADOLESCENTS IN NORTH CAROLINA AND KENTUCKY

Jordan Elizabeth McDonald
University of Kentucky, jmc295@uky.edu
Digital Object Identifier: https://doi.org/10.13023/ETD.2017.436

STUDENT AGREEMENT:

I represent that my thesis or dissertation and abstract are my original work. Proper attribution has been given to all outside sources. I understand that I am solely responsible for obtaining any needed copyright permissions. I have obtained needed written permission statement(s) from the owner(s) of each third-party copyrighted matter to be included in my work, allowing electronic distribution (if such use is not permitted by the fair use doctrine) which will be submitted to UKnowledge as Additional File.

I hereby grant to The University of Kentucky and its agents the irrevocable, non-exclusive, and royalty-free license to archive and make accessible my work in whole or in part in all forms of media, now or hereafter known. I agree that the document mentioned above may be made available immediately for worldwide access unless an embargo applies.

I retain all other ownership rights to the copyright of my work. I also retain the right to use in future works (such as articles or books) all or part of my work. I understand that I am free to register the copyright to my work.

REVIEW, APPROVAL AND ACCEPTANCE

The document mentioned above has been reviewed and accepted by the student's advisor, on behalf of the advisory committee, and by the Director of Graduate Studies (DGS), on behalf of the program; we verify that this is the final, approved version of the student's thesis including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Jordan Elizabeth McDonald, Student

Dr. Alison Gustafson, Major Professor

Dr. Sandra Bastin, Director of Graduate Studies

FINDING THE LINK BETWEEN SOCIAL CONNECTIVITY AND DIETARY INTAKE AMONG RURAL ADOLESCENTS IN NORTH CAROLINA AND KENTUCKY

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Nutrition and Food Systems in the College of Agriculture, Food and Environment at the University of Kentucky

By

Jordan Elizabeth McDonald

Lexington, Kentucky

Director: Dr. Alison Gustafson, Professor of Dietetics and Human Nutrition

Lexington, Kentucky

2017

ABSTRACT OF THESIS

FINDING THE LINK BETWEEN SOCIAL CONNECTIVITY AND DIETARY INTAKE AMONG RURAL ADOLESCENTS IN NORTH CAROLINA AND KENTUCKY

Social networks play a significant role in adolescent decision making, specifically when it comes to dietary outcomes. This study, granted by the United States Department of Agriculture (USDA), assessed the connectivity of these social networks and the impact they have on fruit and vegetable, added sugar and sugar sweetened beverage consumption. Additionally, the relationship between shopping companionship and dietary choices was studied. Positive and negative associations were found among adolescents who shop with parents or friends. It was also found that those adolescents with greater social network cohesion were found to have more negative dietary outcomes. Divulging further into the relationships within adolescent social networks may improve fruit and vegetable and decrease added sugar consumption within rural communities.

KEYWORDS: Social network, connectivity, companionship, cohesion, dietary outcomes,

Jordan Elizabeth McDonald

November 17, 2017

FINDING THE LINK BETWEEN SOCIAL CONNECTIVITY AND DIETARY INTAKE AMONG RURAL ADOLESCENTS IN NORTH CAROLINA AND KENTUCKY

By

Jordan Elizabeth McDonald

Alison Gustafson, PhD, RD, LD
Director of Thesis

Sandra Bastin, PhD, RD, LD
Director of Graduate Studies

November 17, 2017

ACKNOWLEDGMENTS

I would like to thank everyone who assisted, encouraged and supported me during the development of this thesis. I would first like to thank my committee chair, Dr. Alison Gustafson for her constructive criticism, guidance and encouragement. This research would not have been possible without all her efforts. Additionally, I would like to thank my committee members, Dr. Heather Norman-Burgdolf and Dr. Julie Plasencia, for their additional support and feedback during the writing process. The collaboration and guidance provided by the Department of Dietetics and Human Nutrition faculty was outstanding. I would also like to thank a close friend, Yolanda Jackson, for pushing me to apply to graduate school to further my education. Thank you to the University of Kentucky for providing me with the opportunity to be a research assistant throughout my course work. A special thank you to my coworkers at Good Samaritan Hospital for their ability to be flexible with my schedule and allow me to continue practicing as a clinical dietitian throughout graduate school. Lastly, I would like to thank my family and friends for the endless love and support. The tough weeks were easier with words of encouragement from those who mean the most to me.

TABLE OF CONTENTS

LIST OF TABLES

Chapter One: Introduction

Background

Adolescent obesity continues to rise in prevalence with approximately 17% of children and adolescents in the United States (U.S.) classified as obese (Ogden et al., 2016). More specially, rural communities tend to have a higher prevalence of obesity compared to those adolescents of urban communities (Singh et al., 2008). This is of utmost concern since adolescent obesity leads to an increased risk for chronic disease development and an obese adulthood (Marshall et al., 2017; Bruening et al.,2012; Davis et al., 2009; Bevelander, Anschutz & Engels, 2011). One construct that may influence overweight and obesity is the social network that adolescents take part in. It is hypothesized that a dense overweight or obese social network (being friends with individuals who are overweight or obese) will influence the development of unhealthful behaviors therefore resulting in increased body mass index (BMI), increased consumption of added sugars and decreased consumption of fruits and vegetables. In addition, adolescents do not meet the dietary guidelines for fruit and vegetable consumption and perhaps the peers whom adolescents trust may facilitate more or less healthful eating patterns (Sawka et al., 2015).

While adolescent dietary patterns remain suboptimal, there has been an increase in curiosity of the role that parents and peers may play in influencing food choices. Parental influence has a strong influence on adolescent dietary intake (Larsen et al., 2015) but the relationship among adolescents and their peers is less understood. Eating and shopping in the presence of others, meal time duration and group size are all

factors within a social network that may influence dietary outcomes (Salvy et al., 2012a). These factors may influence group dynamic and have a role in food choices and caloric intake. The desire of adolescents to model their peer's dietary habits to gain acceptance has been thoroughly studied and known to have significant effects on dietary outcomes (Sawka et al., 2015). In addition to the influence social networks have on eating habits, they are hypothesized to also have an impact on shopping choices.

To understand these social networks further and their influences on adolescent dietary habits, it is important to understand who makes up these social networks. Parents, peers, siblings, etc. all may play a different role in consumption of fruits, vegetables, added sugars, sugar sweetened beverages and overall BMI. Once these specific roles are understood, proper interventions can be developed to optimize the benefits that adolescents' social networks have on dietary intake and minimize the shortcomings.

Problem Statement:

Studies have been conducted to examine the consumption of fruit, vegetables and added sugars among adolescents, as well as how this consumption may be influenced by social networks. There is a magnitude of research that studies parental influences on adolescent dietary intake but more limited research on the association between peer networks and adolescents' dietary intake. Also, limited research exists that examines the relationship between shopping companionship and dietary outcomes amongst rural adolescents. The aim of this study is to help fill in this missing research gap.

Purpose:

The purpose of this study was to determine the relationship between social networks among rural adolescents in Kentucky and North Carolina and dietary intake of added sugars, sugar sweetened beverages and fruits and vegetables. Additionally, to determine the association between shopping companionship and dietary outcomes among rural adolescents.

Research Aims:

1. Determine the association between those who shop for food with a parent or friend at various food venues and dietary intake compared to those who shop alone.
2. Determine the association between social network connectivity (those who share intimate details about life and eat meals with those same individuals) among adolescents and dietary intake.

Research Hypotheses:

1. Those who have shopping companionship with family members will consume more fruits and vegetables and less added sugars compared to those who have shopping companionship with friends or alone.

2a. Greater social connectivity will be positively correlated with the higher intake of fruits and vegetables and less consumption of added sugars.

2b. Those adolescents with a denser network of family compared to a denser network of friends will consume more fruits and vegetables and less added sugars than other adolescents.

Justification:

The lack of fruit and vegetable intake and increase in added sugar consumption among rural adolescents is a significant contributing factor in the increased prevalence of adolescent obesity in the U.S. Though the health promoting behaviors to prevent chronic disease development are known, adoption of these behaviors is limited therefore resulting in an increase in obesity and thus healthcare costs (CDC, 2014). Social networks have been shown to affect dietary outcomes among adolescents by influencing dietary intake and food selections. The results of this study may provide further insight into the specific influence of peers and family members within these adolescent networks and their influence on dietary outcomes such as fruit, vegetable, sugar sweetened beverage and added sugar consumption and food shopping choices.

Chapter Two: Literature Review

Introduction

The purpose of this study was to determine the relationship between social network connectivity, how connected or intimate an individual is with those they consume food with (Herman, 2017), among rural adolescents and dietary intake of key dietary outcomes such as added sugars, sugar sweetened beverages and fruits and vegetables. Attitudes and beliefs towards overall healthfulness are developed during childhood and adolescence and may be influenced by those within their social network, such as friends, classmates and family members. During this critical developmental time point, peers begin to exert more influence on dietary choices relative to parents. It is hypothesized that those who share intimate details about their life and share meals with those same individuals, will have "connectivity" that influences the development of behaviors therefore resulting in less intake of added sugars and greater consumption of fruits and vegetables. Additionally, those who are more connected with family members, rather than peers, will report higher consumption of fruits and vegetables and less added sugars. This study focuses specifically on how adolescents sharing meals with those who feel the same sense of intimacy, might be influenced on their dietary intake and weight status.

Adolescent Obesity

Childhood and adolescent obesity prevalence has continued to worsen over the years. Between 1980 and 2002 overweight prevalence tripled among adolescents 6 to

19 years of age (Ogden et al., 2006). Using data collected between 2011 and 2014, the Centers for Disease Control and Prevention (CDC) estimated that 17% of adolescents ages 2-19 years old are obese (CDC, 2014; McCormack and Meendering, 2015). Of the 17% of adolescents classified as obese, adolescents aged 12-19 years of age had the greatest prevalence of obesity (20.5%) compared to 6-11 years of age (17.5%) and 2-5 years of age (8.9%) (CDC, 2014).

Increases in weight lead not only to a stronger likelihood for obesity as an adult (Davis et al., 2009), but also increased risk for chronic disease development. These diseases may include, but are not limited to, diabetes, cardiovascular disease, psychological disorders and bone or joint issues (McCormack and Meendering, 2015). Some authors attribute unhealthy eating and physical inactivity as the "Big Two" factors that led the U.S to an obesity epidemic (Salvy et al., 2012a).

Rural Adolescent Obesity

There is an influx of data regarding the differences in prevalence of adolescent obesity between rural and urban populations. Rural residents struggle with socioeconomic disadvantages such as high poverty and unemployment rates, lower literacy levels, and lack of access to nutrient dense foods compared to urban populations which may attribute to their higher rates of obesity (Bardenhagen et al., 2017; Davis et al., 2011; Bardach et al. 2011). Several studies have found that those in rural communities report higher rates of obesity (Davis et al., 2011; Liu et al., 2012). Lack of access to nutrient dense food poses a threat to rural residents primarily due to the distance between home and grocery stores. Many local rural stores struggle to

sustain a healthful business due to the challenge of maintaining fresh produce and other healthful items such as fresh meat and dairy (Bardenhagen et al., 2017). Due to the lack of healthful food access, many rural residents will spend an entire day driving to the closest populated city to obtain groceries and other household items. This phenomenon can be referred to as "out shopping" (Bardenhagen et al., 2017). In addition, research shows that lack of nutrient dense food access has resulted in rural adolescents consuming higher amounts of calories from refined sugars and saturated fat (Crooks, 2000).

Along with rural and urban community comparison, geographic regions should be considered throughout the U.S when looking at the causes of adolescent obesity. Finding discrepancies among geographic regions may provide useful information for the initiation of region specific weight reduction programs. Recent findings have shown that adolescents from West Virginia, Kentucky, Texas, Tennessee and North Carolina were more than twice as likely to be obese compared to other states (Singh et al., 2008). In this study, Kentucky had 20.63% of adolescents who participated in the study classified as obese (Singh et al., 2008). The Southern region not only has a high adult obesity prevalence but also a matching prevalence for childhood obesity greater than any other region (Singh et al., 2008). Although obesity is a complex problem, one key factor is dietary intake, especially among adolescents.

Fruit and Vegetable Intake

Healthful eating is important for all age groups, but even more important in adolescence due to the rapid growth and development of the body during those years.

It is well known in America that adolescent fruit and vegetable consumption is way below the daily recommended intake (DRI) (Dietary Guidelines for Americans, 2015). The types of fruits and vegetables typically consumed by adolescents are tomatoes, potatoes (French-fried), bananas, oranges (juice) and iceberg lettuce (Lorson et al., 2009). Though the vegetables listed can be considered healthier than processed foods, nutrient dense fruits and vegetables continue to be lacking in adolescent diets. These nutrient dense fruits and vegetables should include green leafy, yellow/orange and cruciferous vegetables and citrus fruits (Lorson et al., 2009). Several studies have highlighted overall dietary intake trends with a high percentage of vegetables in the adolescent diet consisting of French fries (Lorson etl al., 2009), high intake of sugar-sweetened beverages (Marshall et al., 2017), and processed foods (Briefel, Wilson & Gleason, 2009). Taken together, the adolescent dietary pattern is low in fruit and vegetables and high in added sugars.

Added Sugar Intake

Beverages are consumed many times throughout the day and beverage choices are often selected based on flavor, nutritional adequacy and/or health benefits (Marshall et al., 2017). Sugar sweetened beverage (SSB) intake is one of the most unhealthful food items that adolescents consume. In addition to sugary beverages, low nutrient and energy dense food items such as brownies, cookies, pastries and other baked goods are often favored compared to fresh fruits and vegetables (Briefel, Wilson & Gleason, 2009). These added sugar foods are also known as “junk foods” and “empty calories” which have been strongly correlated with increased energy intake which

further results in a higher BMI (Briefel, Wilson & Gleason, 2009). Several studies have shown that added sugar consumption is greater in adolescents when at home rather than at school (Briefel, Wilson & Gleason, 2009; Maximova et al., 2008). This reasoning is likely due to the presence of the National School Lunch Program (NSLP) and School Breakfast Program (SBP) within the school systems. Most rural children eat two of their three daily meals at school. Once at home, snack choices and meal times may be negatively influenced by family resources, increased frequency of eating and increased portion sizes which all attribute to an increase in BMI (Briefel, Wilson & Gleason, 2009).

Adolescent Social Networks

A social network indicates relationships or connections with peers, friends, family members, coworkers and/or other individuals (Bahr et al., 2009). Specifically, connectivity is how connected individuals are with those members within their social network. Research indicates that a dense social network with a significant prevalence of overweight and obesity will promote weight gain among adults (Maximova et al., 2008). Through social network analysis, which examines the influence of social relationships (Fletcher, Bonell & Sorhaindo, 2011), these networks can be studied to better understand the structure that friends and family members provide (Sawka et al., 2015). For example, increased energy intake among adolescents has been positively correlated with excessive energy intake among parents and friends of those adolescents (Salvy et al., 2012a).

The relationships that adolescents develop have been hypothesized to influence dietary intake. Researchers have reported that the foundation of eating behavior

develops during childhood and may be influenced by factors such as healthy food at school, parental modeling and taste preferences (Bruening et al.,2012). Adolescents frequently form perceptions of their friends eating patterns and often wonder what opinions their friends have of them, and at times these perceptions may influence behavior change (Salvy et al., 2012a).

A study analyzed a large data set from the Framingham Heart Study and concluded that weight gain spreads from person to person via their connections within their social network (Christakis & Fowler, 2007). To simplify, weight gain among an individual will directly correlate with any weight gain of their friends and family. Multiple studies also note that individuals typically associate themselves with those of a similar BMI (Christakis & Fowler, 2007; Bahr et al., 2009), which can also be defined as homophily (Fletcher, Bonell & Sorhaindo, 2011). Authors recognize that the physical environment may affect dietary outcomes, but now confidently report that the social environment can play a large role on dietary outcomes, especially among adolescents (Bahr et al., 2009). A unique aspect of a social network is that it can influence individuals without them being aware they are being affected. The effects of social networks on dietary outcomes may be deliberate, unintentional, conscious or unconscious (Bahr et al., 2009). Being that individuals may not be consciously aware that social influences are changing their eating habits, it may be hard to fully assess the origin of influence (Feunekes et al., 1998). It is known that obesity and eating disorders originate from social connections and are strongly contagious among adults (Fletcher, Bonell & Sorhaindo, 2011).

There are three main aspects that are recognized as social influences prompting dietary patterns, (1) social facilitation, (2) modeling, and (3) impression management (Salvy et al., 2012a). Social facilitation looks primarily at consumption in group settings versus alone and determines that subjects eat more in a group setting due to increased meal times and discussion, compared to when eating alone. Modeling is when subjects tend to conform their eating patterns to those whom they are eating with resulting in eating more or less depending how much their meal time companions are eating. Finally, impression management focuses on the changes subjects make to their eating habits when they feel a sense of being observed. Merely, eating less than normal to impress others, compared to the amount they would typically consume alone.

In the 1980's, John de Castro first used the term "social facilitation" and defined it as the increase in food intake that occurs when people eat together (de Castro, 1990). Recent research has looked at peer influence on eating activity during childhood. Key outcomes from this review indicated that the duration of meal times and group size may be a factor leading to increased energy consumption (Salvy et al., 2012a; Herman, 2017). For example, eating with others is thought to indirectly increase energy consumption by automatically increasing the duration of the meal due to added conversation (Salvy et al., 2012a). On average, those who eat in a group tend to consume 44% more than if they were eating alone (de Castro & de Castro, 1989). A separate study found similar results, concluding that people were consuming 30% more in a group setting compared to when eating alone (Patel & Schlundt, 2001). In a group setting, which is defined as two or more people, there is increase in conversation and

when one is not conversing they have more opportunity to eat. The larger the group, the longer the meal time which ultimately provides greater opportunity for over indulgence (Herman, 2017). Eating in a large group is also hypothesized to promote distraction. When eating alone, one might be more aware of how much they are eating or sense the feeling of satiety however, in a group setting full of distraction that awareness may be masked (Herman, 2017).

Although eating in large, familiar groups may be an important independent factor, adolescents eat less in the presence of unfamiliar people in attempts to make a positive impression (Salvy et al., 2012a). Researchers also attribute impression management to effect adolescent eating patterns, hypothesizing that those concerned with how they are perceived by others communicate this concern by eating less or more healthful (Salvy et al., 2012a). "Matching other people's intake is a way of establishing a connection with them, of fulfilling an implicit social contract, and of not embarrassing them by eating less than they do" (Herman, 2017, p. 4). Results from this study and others found that group dynamics during meals among adolescents may be a key factor in meal time duration and overall caloric intake (Herman, 2017; de Castro & de Castro; 1989). This may seem contradictory to social facilitation, but in a situation of impression management the presence of others may suppress appetite in hopes of making a desirable impression (Herman, Roth & Polivy, 2003).

Modeling is another aspect of social influence hypothesized to affect dietary patterns. This tends to occur when a "norm" is established by a dining companion. This dining companion however does not necessarily need to be present at meal times to be

modeled (Higgs & Thomas, 2016). Often modeling will occur from picking up on environmental cues or what is portrayed via social media (television, internet, etc.). Modeling occurs regardless of state of hunger, age or health goals and is not just performed to achieve a physical similarity (Higgs & Thomas, 2016). Children often start to model eating behaviors portrayed by parents at a young age, and then these behaviors change as they grow into adolescence and begin sharing meal times with peers. During adolescence, social acceptance is of utmost desire, therefore modeling may be enhanced in attempts to strongly identify with a certain group of peers. Though acceptance is desired, those adolescents who have high self-esteem and empathy for others tend to be confident with their own social norm and are not as concerned with how they are perceived by others (Robinson et al., 2011).

In the life of adolescents who are attending school, sharing meals with friends is an everyday occurrence. While at school, it can be assumed that meals are eaten in a social context given the large cafeteria setting and designated times allotted for eating. When individuals are experiencing an intense feeling such as hunger or satiety, their behaviors are quick to satisfy that urge. However, when a person is at neither end of that spectrum, research shows that their dietary patterns are more likely to be influenced by social or environmental factors (Goldman, Herman & Polivy, 1991). Many adolescents conform their behaviors to exemplify what is to be considered a "social norm" (Higgs & Thomas, 2016). It is hypothesized that the desire to be socially normal is the underlying force driving social facilitation, modeling and impression management to imitate adolescent dietary behaviors and thus, dietary patterns (Higgs & Thomas, 2016).

A social network is only considered one aspect of social support, along with emotional support, esteem, instrumental support and active support (Bardach et al., 2011). Adolescents growing up in a social network with a significant prevalence of obesity may struggle to accurately perceive a healthful weight status. Over time it may become a social norm to be overweight which will lead to increased susceptibility to disease development and an unhealthful adulthood (Salvy et al., 2012a). Further research that dives deeper into the emotional relationships within these social networks may provide more information pertaining to adolescent weight status.

Adolescent Social Network & Dietary Outcomes

A review in 2013 indicated that there were significant associations found in fast food, soft drink and snack food consumption among friend networks, such that those with unhealthful intake had friends that also consumed similar unhealthy food items (Sawka et al., 2015). This type of behavior may have a "contagion" effect (Christakis & Fowler, 2007) or it may simply reflect back on how individuals choose to spend time with others who are similar to themselves (Shoham et al., 2012; Flatt, Agimi & Albert, 2012).

As dietary intake relates to social modeling by mimicking the behaviors of those around them, several studies have found that this may influence dietary choices because people see the amount of food that their friends are eating as an indicator of how much they should or should not eat to be socially acceptable (Cruwys, Bevelander & Hermans, 2015; Herman & Polivy, 2005). These social norms of eating, whether through impression management, social facilitation or modeling, all more or less depend

on group dynamics and have been well documented (Salvy et al., 2012a; Herman & Polivy, 2005; Herman, 2017). Specifically, a study compared the eating patterns of normal weight participants against obese participants when eating with a designated model. The results concluded that both groups, obese and normal weight, equally conformed to the model's eating patterns by eating more or less, just as the model consumed, regardless of BMI status (Conger et al., 1980).

Though we know that social networks may influence dietary outcomes in a negative way, there are occasions when these networks take a positive effect. One study examined the positive effect of eating behaviors among adolescents and their friends' dietary intake. Results concluded that vegetable intake increased by 0.9 servings for each additional serving of their best friend's reported vegetable intake (Bruening et al., 2012). This finding suggests that adolescents can influence a pro-social behavior just as much as consuming unhealthy food items. Other evidence points to the distinct role the peers play in shaping food choices.

Many eating patterns are developed during the adolescent phase of life and if not addressed have the potential to form detrimental habits that will become difficult to change once in adulthood (Stok et al., 2015). Temptation is present daily with calorie and fat dense snacks and beverages available in the eating environment and it has been shown that peers influence greater fat and junk food consumption (Feunekes et al., 1998). Recent research is more concerned with what level of influence peers are inflicting on adolescents giving into these temptations. Researchers conducted a study to look at the level of support portrayed within social networks towards healthful eating

versus the level of support for discouraging unhealthful eating (Stok et al., 2015). Results concluded that peers were neutral towards encouraging healthful eating habits but were found less likely to discourage unhealthful eating (Stok et al., 2015). Adolescents were more likely to encourage healthy eating than discourage unhealthful eating, which demonstrated that peer encouragement of healthy foods was associated with decreased intake of unhealthful foods (Stok et al., 2015). However, only the encouragement of healthful eating increased fruit and vegetable consumption among adolescents, but not the discouragement of unhealthful eating (Stok et al., 2015). More research needs to be conducted to look at the rates of peer approval and disapproval of healthy eating to fill in this missing research gap. The promotion of healthier eating habits amongst adolescent social networks in a positive light may be the key to increased fruit and vegetable consumption.

Many adolescents concerned with self-image or acceptance may choose to control their overeating habits in the presence of others (Goldman, Herman & Polivy, 1991). In today's world, individuals of the same social network work together to try and lose weight by going to the gym, dieting or attending fitness classes together. There is some success behind these groups, however research shows frequently that those of normal body weight will continue to be surrounded by a larger population of overweight and obese individuals, which increases the risk for relapse (i.e. weight gain) (Bahr et al., 2009). The authors concluded that though weight loss activities with friends is a good short-term solution, the effectiveness as a long-term solution is minimal unless the social network connections are extremely strong (Bahr et al., 2009).

Adolescent Food Shopping Companionship

During childhood and adolescence, it is assumed that family members are accompanying adolescents during shopping trips, but the influence of these family members or parental figures on food selections desired by adolescents remains unknown. Similarly, as adolescents distance themselves from their parents during teenage years, the role of peer influence on food purchases is also fairly unknown. Adolescents are a targeted market for food advertisement, with over half of the ads viewed per year related to food (O'Dougherty, Story & Stang, 2006)

Adolescents do not consume as many meals with their families as young children do, but they still eat ~65% of their meals at home (Larson et al., 2006), leaving the rest of meal consumption away from the home. Eating with family members may also prompt preferences and attitude development towards meals served at home and food purchases made for the household (Larson et al., 2006). A study was conducted to examine adolescent shopping choices based off learned behaviors through childhood exposure to parental choices. Parents were asked to complete a questionnaire to establish an understanding for their normal household food items and then adolescents could shop and make dietary choices by themselves. Overall parents endorsed purchasing more healthful items (i.e. whole grain cereals, oatmeal, tomatoes and green beans) more often than unhealthful items (i.e. candy, soda, potato chips and French fries). When the adolescents had the opportunity to do the shopping, they chose an even mixture of healthful and unhealthful foods. Authors concluded that the healthfulness of adolescent food purchases were positively correlated with parental

influence (Sutherland et al., 2008). An additional study assessed the extent to which adolescents were participating in meal preparation and shopping with their parents. Results showed that 49.8% of participants reported accompanying a parent while shopping for groceries one time per week, yet the percentage dropped significantly (17.8%) when asked to report shopping greater than one time per week (Larson et al., 2006).

Socialization is important during adolescence and eating can be considered a form of socialization (Salvy, Kluczynski, Nitecki & O'Connor, 2012b). It is hypothesized that friends impact the selection of healthful and unhealthful foods. Adolescents consume greater than 500 calories from unhealthful foods per day (Briefel, Wilson & Gleason, 2009), with the primary source of unhealthful foods being snack foods. A recent study looked at the relationship between snack purchases when alone versus with a peer among adolescents. Results concluded that participants purchased more healthful snacks when accompanied by a peer, then when shopping alone (Salvy, Kluczynski, Nitecki & O'Connor, 2012b).

A study conducted among rural Kentucky and Ohio counties looked at parent, peer and adolescent food shopping behaviors. Specifically, questions were asked regarding companionship while shopping. Adolescents reported shopping for fast food in the mornings with friends (32%) most often, parents (29%) some of the time and alone (14%) not as frequently (Gustafson et al., 2014). The authors also hypothesized that who adolescents choose to eat with at specific food venues (fast-food, gas stations,

etc.) may potentially play a stronger role in dietary choices, than perhaps simple access to unhealthful food venues (Gustafson et al., 2014).

Summary

While obesity levels have continued to rise among adolescents, the factors thought to influence weight gain have broadened. The role of, and the connectivity within, social networks may influence adoption of undesirable dietary behaviors and food selections. Current research indicates that though parents play a significant role in adolescent dietary intake, that a dense social network of friends and peers may play a stronger role. Adolescent friendships have been proven to have negative impacts on BMI, physical activity, decreased fruit and vegetable consumption and increased added sugar consumption. Adolescents have the desire to be accepted and tend to model those whom they would like to be accepted by. Companionship affects dietary outcomes not only during consumption but also during grocery shopping. Rural adolescents seem to be at a disadvantage due to fewer resources available to improve health status compared to those among urban communities. Increases in fruit and vegetable consumption and decreases in added sugar intake are needed to improve adolescent BMI and overall healthfulness. Though there are studies linked to the adolescent and parental companionship during grocery shopping, there is a gap in the research on the impact of adolescent grocery shopping with friends or alone, and the impact these specific companionships may have on dietary outcomes.

Chapter Three: Methodology

Research Design

Using a cross-sectional survey design, this study measured the impact of social network connectivity on intake of fruits, vegetables, sugar sweetened beverages and added sugars as well as looking at companionship during shopping trips, among adolescents in rural Kentucky and North Carolina. A survey was developed and administered using questions from validated questionnaires from the Youth Impact Questionnaire, Child Impact Questionnaire (CIQ) and the National Health and Nutrition Examination Survey (NHANES) 2009-2010 dietary screener, to gain insight on the influence of social networks on dietary intake and shopping behaviors (Shin et al., 2015; Thompson et al., 2009; Gittelsohn et al., 2010).

Subjects

High schools within targeted rural counties of Kentucky and North Carolina were recruited to participate in the survey. A total of three schools agreed to participate in Kentucky and four schools in North Carolina. The survey was distributed to adolescents between 14 to 16 years of age. Students were considered eligible if English was their primary language and if they did not report having any medical condition that may alter their dietary intakes. These conditions included diabetes, celiac disease and Crohn's disease. In addition to meeting the eligibility criteria, students were required to have signed adolescent assent and parental consent forms. These documents were sent home with eligible students days prior to the administration of the survey to allot adequate time to obtain parental permission. After consent was obtained and surveys

were administered, there were a total of 425 surveys completed among all seven participating schools.

Measurements

The survey developed for this study was approved by the Institutional Review Board (IRB) at the University of Kentucky and included questions regarding gender, age, anthropometrics (self-reported height and weight) and social media use. Adolescents completed a 30 to 40-minute survey via paper which assessed adolescent's social network density, dietary intakes, and shopping companionship.

Youth Impact Survey – Independent Variable

Questions from the Youth Impact Survey were used to understand not only where and how often foods are purchased, but more importantly who is accompanying the adolescent during shopping. The survey asks about companionship when shopping at various venues such as Supermarkets, convenience stores, corner stores, fast-food/carry-out venues and school/rec centers (Appendix A). Possible answers included alone, with parents or with friends (Shin et al., 2015).

NHANES 2009-2010 Dietary Screener Questionnaire – Dependent Variable

This 26-item questionnaire was used to assess frequency of intake of selected foods and drinks. The survey administered to students specifically asked about fruits, vegetables, dairy (calcium), whole grains (fiber), added sugars, red meat and processed meats. Results were categorized into servings per day. Possible answers included: Never, 1-2 times/month, 1-2 times/week, 3-4 times/week and 5 or more times/week (Thompson et al., 2009).

Child Impact Questionnaire – Independent Variable

Questions from the Child Impact Questionnaire were modified to assess adolescent social networks. Participants were asked three main questions: (1) Which of your friends do you tend to eat food with? (2) Of these people which ones do you tend to buy food with whether to eat now or later? and (3) Of the friends listed which ones do you share lots of information about your life with? – examples are when you are upset with your family or if you do poorly on a test. The answers reflected first and last name and grade level of the people participants chose to write down (Appendix B). Participants could write down up to four people for each question asked (Gittelsohn et al., 2010). Companionship, an independent variable in this study, was determined by asking (1) Which of your friends do you tend to eat food with?, followed by (2) Of these people which ones do you tend to buy food with whether to eat now or later? Companionship was coded where 0 = shopped alone; 1=shopped with parents; 2= shopping with friends. Additionally, cohesion, another independent variable, was derived by asking (1) Which of your friends do you tend to eat food with?, followed by (2) Of the friends listed which ones do you share lots of information about your life with? Strong cohesion is defined as sharing details of everyday life and meals with four or more people (as coded as zero). Moderate cohesion is defined as sharing meals and details of everyday life with only two people (as coded as 1) and weak cohesion only shared meals and life details with one person (as coded as 2). This survey was approved by the IRB in January of 2015.

Procedures

Graduate assistants traveled to the participating schools to administer adolescent assent and parental consent forms, and then again on the day of the survey administration. The survey was distributed to freshman and sophomore students in hopes that they will still be attending the school when time comes to implement the intervention. Graduate assistants administered the survey in the selected classes through the entirety of the school day. Graduate assistants walked around the room to assist students with any questions that may have presented. Each student participant received a twenty-five dollar check in the mail for their participation a few weeks after completion of the survey. All participating schools received a financial stipend for participation as well. All surveys were recorded using Research Electronic Data Capture (REDCap) to organize data for statistical analysis.

Data Analysis

Demographic information was collected on all participants, including age, race, gender and ethnicity. Dietary intake of fruits and vegetables, added sugars and sugar sweetened beverages were considered continuous variables. A multivariate linear regression was performed to examine the association between shopping companionship and dietary intakes. This test was controlled for age, gender, race and ethnicity. A multinomial logistics regression was used to determine the associations between dietary intakes and cohesion. Data was imported using STATA data analysis and statistical software.

Chapter Four: Results

A total of 434 students participated in this study. Descriptive sample statistics are described in Table 4.1. Of all student participants, 59% were male (n=256) and 41% were female (n=178). The mean age was 15 years old for all participants. The study sample was diverse in ethnicity with white (62%), black (26%) and other (12%). Other races included American Indian, Asian, Native Hawaiian/Pacific Islander or unknown. Students were asked to indicated all races that applied. A total of 55% of the students were classified as having a normal BMI, 24% as overweight and 21% as obese. The average BMI was 24. BMI was calculate based on self-reported height and weight.

Table 4.1: Descriptive sample characteristics

Demographics	**n=434**
Race	
White	62%
Black	26%
Other	12%
Average Age in Years	15
Gender	
Female	41%
Male	59%
BMI	
Normal	55%
Overweight	24%
Obese	21%
Average BMI	24

Results for shopping companionship while at specified venues are shown in Table 4.2. Students were asked who frequently accompanied them, friends, parents or alone, at ten specified locations ranging from school locations to local shopping venues. Companionship of friends was highest and parents was lowest of the three school

locations, cafeteria, vending and fundraiser. Over half of the students, 67.28%, reported being accompanied by a friend while shopping at the school cafeteria, followed by 21.89% who reported instead shopping alone. At all other locations such as gas stations, restaurants, and grocery stores, companionship of parents was highest and friends was lowest. Reports of shopping alone were lowest at sit-down restaurants (5.07%) and highest at school vending machines (27.88%).

Table 4.2: Descriptive statistics of shopping companionship while at specific locations among rural adolescents in KY and NC in 2017

	Yes	**No**
School Cafeteria		
Friends	292 (67.28%)	142 (32.72%)
Parents	21 (4.84%)	413 (95.16%)
Alone	95 (21.89%)	339 (78.11%)
School Vending		
Friends	227 (52.30%)	207 (47.70%)
Parents	30 (6.91%)	404 (93.09%)
Alone	121 (27.88%)	313 (72.12%)
School Fundraiser		
Friends	178 (41.01%)	256 (58.99%)
Parents	93 (21.43%)	341 (78.57%)
Alone	86 (19.82%)	348 (80.18%)
Gas Station or Convenience Store		
Friends	113 (26.04%)	321 (73.96%)
Parents	317 (73.04%)	117 (26.96%)
Alone	76 (17.51%)	358 (82.49%)
Fast-food Restaurant		
Friends	160 (36.87%)	274 (63.13%)
Parents	320 (73.73%)	114 (26.27%)
Alone	55 (12.67%)	379 (87.33%)
Sit-down Restaurant		
Friends	129 (29.72%)	305 (70.28%)
Parents	336 (77.42%)	98 (22.58%)
Alone	22 (5.07%)	412 (94.93%)

Dollar Store		
Friends	99 (22.81%)	335 (77.19%)
Parents	296 (68.20%)	138 (31.80%)
Alone	67 (15.44%)	367 (84.56%)
Farmers' Market		
Friends	46 (10.60%)	388 (89.40%)
Parents	276 (63.59%)	158 (36.41%)
Alone	34 (7.83%)	400 (92.17%)
Supermarket		
Friends	62 (14.29%)	372 (85.71%)
Parents	333 (76.73%)	101 (23.27%)
Alone	31 (7.14%)	403 (92.86%)
Super Center		
Friends	92 (21.20%)	342 (78.80%)
Parents	332 (76.50%)	102 (23.50%)
Alone	42 (9.68%)	392 (90.32%)

Table 4.2 Continued

A linear regression was used to determine the association between companionship and dietary outcomes at specified venues. The results are displayed in Table 4.3. Those adolescents who shop with friends consume 0.03 (95% CI: 0.003, 0.05) more ounces of sugar sweetened beverages than those who don't shop with friends at gas stations. Additionally, they consume 0.92 (95% CI: 0.16, 1.67) more teaspoons of added sugar at Fast-food restaurants compared to those who shop with parents or alone at this venue. Lastly, those who shop with friends at Super Centers consume 1.07 (95% CI: 0.18, 1.96) more teaspoons of added sugar than those who don't shop with friends. When looking at adolescents who shop with parents, -0.06 (95% CI: -0.11, -0.01) less ounces of sugar sweetened beverages were consumed when shopping at the school cafeteria compared to those who don't shop with parents. There was also a 0.03 (95%

CI: 0.01, 0.06) ounce increase in sugar sweetened beverage consumption when shopping at Super Centers while accompanied by parents. Lastly when looking at sugar sweetened beverage consumption there was a significant association found showing a -0.06 (95% CI: -0.10, -0.02) ounce decrease in consumption when shopping with parents at school vending sites. When shopping with parents at sit-down restaurants 1.12 (95% CI: 0.22, 2.02) more teaspoons of added sugar were consumed compared to those who shop with friends or alone at this venue. Adolescents shopping alone at fast-food venues were found to consume 0.11 (95% CI: 0.005, 0.22) ounces more fruit and vegetables than those who don't shop alone. This was the only statistically significant association found for fruit and vegetable consumption. Additionally, those who shop alone at Dollar Store venues consume 0.99 (95% CI: 0.002, 1.97) more teaspoons of added sugar compared to those who shop with parents or friends. Lastly, those adolescents who shop alone at Super Centers consume -0.04 (95% CI: -0.07, 0.001) ounces less of sugar sweetened beverages than those who don't shop alone. There were no significant associations found when shopping at school fundraisers, supermarkets or farmer's markets.

Table 4.3: Association between dietary outcomes while shopping at specific venues and companionship in rural adolescents in KY and NC in 2017

	Friends	**Parents**	**Alone**
Gas Station or Convenience Store			
SSB	0.03 [0.003, 0.05] *	-0.02 [-0.04, 0.01]	0.01 [-0.01, 0.04]
Added Sugar	0.43 [-0.40, 1.26]	0.41 [-0.44, 1.27]	0.15 [-0.81, 1.10]
Fruits and Vegetables	0.02 [-0.06, 0.11]	0.03 [-0.05, 0.12]	0.02 [-0.08, 0.11]
Supermarket			
SSB	0.01 [-0.02, 0.04]	-0.01 [-0.04, 0.01]	-0.01 [-0.05, 0.03]
Added Sugar	0.82 [-0.22, 1.86]	-0.33 [-1.23, 0.57]	0.74 [-0.69, 2.18]

Fruits and Vegetables	0.04 [-0.07, 0.14]	0.07 [-0.01, 0.16]	0.004 [-0.14, 0.14]
Fast-food Restaurant			
SSB	0.01 [-0.02, 0.03]	0.02 [-0.01, 0.04]	0.02 [-0.01, 0.05]
Added Sugar	0.92 [0.16, 1.67] *	0.50 [-0.36, 1.37]	0.37 [-0.74, 1.47]
Fruits and Vegetables	0.05 [-0.03, 0.12]	-0.05 [-0.13, 0.04]	0.11 [0.005, 0.22] *
Dollar Store			
SSB	-0.005 [-0.03, 0.02]	0.004 [-0.02, 0.03]	0.001 [-0.03, 0.03]
Added Sugar	0.69 [-0.16, 1.54]	0.33 [-0.46, 1.12]	0.99 [0.002, 1.97] *
Fruits and Vegetables	0.02 [-0.06, 0.11]	0.005 [-0.07, 0.08]	0.02 [-0.12, 0.08]
School Cafeteria			
SSB	-0.001 [-0.02, 0.02]	-0.06 [-0.11, -0.01] *	0.01 [-0.01, 0.04]
Added Sugar	0.38 [-0.42, 1.18]	-0.07 [-1.89, 1.75]	0.44 [-0.44, 1.33]
Fruits and Vegetables	0.02 [-0.06, 0.10]	-0.02 [-0.20, 0.16]	-0.06 [-0.15, 0.03]
Sit-down Restaurant			
SSB	0.003 [-0.02, 0.03]	-0.002 [-0.03, 0.02]	-0.01 [-0.05, 0.04]
Added Sugar	0.51 [-0.28, 1.31]	1.12 [0.22, 2.02] *	-0.07 [-1.70, 1.57]
Fruits and Vegetables	0.01 [-0.07, 0.09]	0.08 [-0.01, 0.17]	-0.07 [-0.23, 0.09]
Super Center			
SSB	-0.02 [-0.04, 0.006]	0.03 [0.01, 0.06] *	-0.04 [-0.07, 0.001] *
Added Sugar	1.07 [0.18, 1.96] *	0.36 [-0.55, 1.27]	1.01 [-0.26, 2.28]
Fruits and Vegetables	0.05 [-0.04, 0.14]	-0.01 [-0.10, 0.08]	0.02 [-0.11, 0.14]
School Vending			
SSB	0.001 [-0.02, 0.02]	-0.06 [-0.10, -0.02] *	0.003 [-0.02, 0.03]
Added Sugar	0.52 [-0.22, 1.26]	0.70 [-0.78, 2.17]	-0.09 [-0.92, 0.73]
Fruits and Vegetables	0.03 [-0.04, 0.10]	0.01 [-0.15, 0.16]	-0.01 [-0.09, 0.07]
School Fundraiser			
SSB	0.001 [-0.02, 0.02]	-0.02 [-0.04, 0.01]	0.005 [-0.02, 0.03]
Added Sugar	0.62 [-0.12, 1.35]	0.81 [-0.07, 1.69]	0.23 [-0.69, 1.16]
Fruits and Vegetables	0.03 [-0.04, 0.11]	-0.01 [-0.10, 0.07]	-0.04 [-0.13, 0.05]
Farmers' Market			
SSB	0.01 [-0.03, 0.04]	-0.01 [-0.04, 0.01]	
Added Sugar	-0.14 [-1.35, 1.07]	0.25 [-0.51, 1.02]	0.25 [-1.11, 1.62]
Fruits and Vegetables	0.03 [-0.09, 0.15]	0.02 [-0.05, 0.10]	-0.02 [-0.16, 0.11]

Table 4.3 Continued

*****Indicates p-value <0.05

Displayed in Table 4.4, a multinomial logistic regression was used to look at the association between the strength of cohesion and dietary outcomes. There were no significant associations found when looking at sugar sweetened beverage consumption and cohesion. Adolescents with moderate cohesion were found to consume 0.09 (95% CI: 0.0008, 0.18) more teaspoons of added sugar compared to those with weak cohesion. In addition, moderate cohesion among adolescents showed a -0.03 (95% CI: -0.06, -0.0002) ounce decrease in fruit and vegetable consumption compared to those with weak cohesion.

Table 4.4: Association between dietary outcomes and cohesion in rural adolescents in KY and NC in 2017

	Added Sugar	**Fruits & Vegetables**
Moderate Cohesion	0.09 [0.0008, 0.18) *	-0.03 [-0.06, -0.0002] *
Weak Cohesion	0.03 [-0.04, 0.09]	-0.006 [-0.026, 0.015]

*****Indicates p-value <0.05

**0: Strong cohesion, 1: Moderate cohesion, 2: Weak cohesion; Reference is strong cohesion

Chapter Five: Discussion

The purpose of this study was to examine social connectivity and the influence it projects on (1) shopping companionship and (2) the strength of social network connectivity, also known as cohesion, on dietary outcomes such as fruit and vegetable, added sugar and sugar sweetened beverage consumption among rural adolescents in Kentucky and North Carolina. Results indicated that shopping alone, with parents or with friends all had different impacts on dietary outcomes, some positive and some negative. Moderate cohesion, eating and socializing with two friends, was found to have more of a negative impact on dietary consumption compared to weak cohesion, eating and socializing with one friend.

Research has found a positive relationship between adolescent shopping choices and being accompanied by an adult compared to shopping alone (Sutherland et al., 2008). The results supported the hypothesis of increasing fruit and vegetable consumption and decreasing added sugar consumption in the adolescent diet due to parental influence, however the current study contradicts these results. While shopping with parents at Super Centers and sit-down restaurants, adolescents were found to consume more ounces of sugar sweetened beverages and teaspoons of added sugar. These findings do not support the hypothesis that adolescents make food choices from learned behaviors during the adolescence phase of life (Sutherland et al., 2008), but instead suggest that the food environment at specific food venues may be influential. Considering the venues of significance, it is important to take into account the tremendous variety of sugar sweetened beverages available at a Super Centers

compared to a different location, such as a gas station. A recent study looked at the availability of food among different food venues and how this impacted food choices among Kentucky adults. Results found that frequently shopping at supermarkets led to increased SSB consumption (Gustafson et al., 2013). Controversially, the same study also found that shopping at supermarkets with a high availability of healthful foods led to lower consumption of SSB (Gustafson et al., 2013). These contraindicating results demonstrate the importance of type of foods available within each supermarket that may influence good or bad shopping behaviors. This is a very important aspect to consider when looking at rural populations specifically. A study conducted in the United Kingdom assessed the healthfulness of food venues by specifically looking at store type and neighborhood deprivation. Results showed a greater decline in the quality of fresh produce and healthy food alternatives given the greater level of neighborhood deprivation (Black et al., 2014). Local grocery stores among rural communities may not have as many food options as the supermarket 60 miles down the road however this may eliminate temptation that often arises when shopping in larger venues to purchase excess junk foods. Among rural communities it is known that often families will travel to larger supermarkets or supercenters once a week or once every two weeks in hopes of attaining all grocery and household items in one single trip. The results of this current study seem to have similar findings and suggest that rural families are out shopping more and shopping at local food venues less frequently.

Eating out tends to be an indulgence for some rural families, therefore additional added sugar and SSB consumption in the adolescent diet may be foreseen due to an

attempt at enjoying an evening out with the family. In the 1970's only 2% of an adolescent's diet was comprised of fast-food. By the 1990's, that percentage had increased to 10% (Bauer et al., 2008). A study was conducted among young adults that looked at the effects on dietary outcomes depending on the type of fast-food venue eaten at. Results showed that burger-and-fries restaurants were associated with decreased intake of fruits and vegetables and increased intake of SSB (Larson et al., 2011). It is also known that fast-food venues are greatly associated with increased calorie, total fat, saturated fat and sodium intake (Larson et al., 2011). Geographic location has to be considered when looking at food venue availability. It has been shown that there are less available full-service or sit-down restaurants available in lower income communities compared to those of higher income. Studies have shown that 40% of young adults of higher socioeconomic status eat at a sit-down restaurant at least once a week compared to only 25% of those of lower socioeconomic status (Larson et al, 2011). This is likely due to the decreased availability of sit-down restaurants and increased availability of fast-food restaurants. Though portions are considered larger at sit-down restaurants, there tend to be more healthful foods available compared to the options provided at fast-food venues.

A positive association was reported with fruit and vegetable consumption and eating at fast-food venues with no one accompanying the adolescent. Seeing that adolescents want to increase their fruit and vegetable consumption, especially at fast-food venues which typically have limited healthful options, is reassuring. Though there was only one positive association found with fruit and vegetable intake, this finding

suggests that being alone in a "tempting" location may allow for personal choices to overcome modeling, impression management and social facilitation. A study among adolescents used focus groups to learn more on the influence of knowledge of calorie requirements and menu label awareness. It was found that adolescents living in a lower income communities had very little knowledge on calorie requirements compared to those in higher income communities (Evans et al., 2016). Similarly, adolescents in lower income communities reported having no parental persuasion when choosing food items at fast-food venues, whereas those in higher income communities reported getting reprimanded for their unhealthful choices (Evans et al., 2016). It was found that cost and taste were the greatest factors influencing adolescent choices when at sit-down restaurants and fast-food venues. Due to these findings, it would be useful to further investigate the impact that taste has on purchases of healthful foods at additional locations such as supermarkets, school cafeterias, etc. Additional research looking at adolescent food choices when eating and shopping alone would be useful to see how each adolescent's personal food preferences influence these choices.

The results displayed an interesting statistical significance between shopping companionship and decreased sugar sweetened beverage consumption. It was found that adolescents consumed less ounces of SSB when shopping at the school cafeteria and school vending machines with the accompaniment of a parent. This data is perplexing considering that there are very few scenarios when students are accompanied by a parent at school venues. School vending machines may be open after school hours during sporting events, etc. however school cafeterias are typically closed

after daily breakfast and lunch services. A study examined physical activity patterns, eating behaviors and social environments among normal weight and overweight middle school students between the hours of 3:00 PM and 12:00 AM (Miller et al., 2012). The time frame was chosen due to an increased likelihood of adolescents participating in unsupervised activities during those hours. Eating behavior results showed that time spent eating healthful food was correlated with spending time with family whereas unhealthful food consumption was related to time spent with friends (Miller et al., 2012). The authors also found differences among normal weight and overweight middle school students and when they were choosing to consume healthful foods. Parents are hypothesized to promote healthful intake among adolescents, but few studies have looked at the weight status of those adolescents. It could be argued that those adolescents of normal weight are not encouraged to consume as many healthful foods due to parents' feeling that overweight status is not a concern they have for their child. Those parents of overweight adolescents may feel differently and encouraged greater intake of healthful foods in hopes of improving the weight status of their child. Being under parental supervision may promote greater levels of physical activity and healthful eating, however weight status of the adolescent could enhance or diminish the strength of this influence as well. Additionally, parents often will set limits on the consumption of certain unhealthful foods and research has shown this is only effective on young children (Zabinski et al., 2006). Limit setting on food choices for adolescents by parents has displayed a negative impact on SSB consumption by adolescents, with a defiant greater consumption. (Nickelson, Roseman & Forthofer, 2010).

Some research has found that adolescents purchased more healthful snacks when accompanied by a peer compared to when shopping alone (Salvy, Kluczynski, Nitecki & O'Connor, 2012b). Controversially, more research has been found supporting the negative effects on dietary intake when shopping with a peer. Authors have suggested that peers serve as guides when shopping, likely influencing adolescents to choose foods that they feel are appropriate in that given situation (Herman & Polivy, 2005). It is thought that purchasing behaviors are similar to those behaviors of eating while being accompanied by peers. A study conducted among teenage girls supported this theory when they found that girls purchased higher calorie foods when shopping with peers while at supermarkets (Bevelander, Anschutz & Engels, 2011). Additionally, researchers have also found that children consume more unhealthful snacks when in the presence of peers compared to the presence of their mothers (Salvy et al., 2011). It was found in this current study that adolescents who shopped with friends at gas stations, fast-food venues and Super Centers consumed more teaspoons of added sugar than those who shopped with parents or alone. These results support the theories of social facilitation, modeling and impression management and their influence on adolescent dietary habits.

The research regarding the strength of social networks influencing dietary outcomes is very limited, especially when looking at an adolescent population. Though it was hypothesized that greater social network cohesion would be correlated with an increase in fruit and vegetable and a decrease in added sugar consumption, this study's results disagree. There were statistically significant findings among those adolescents

with moderation cohesion however those findings found an increase in added sugar consumption and a decrease in fruit and vegetable consumption. Obesity prevalence has drastically increased over the years and is often called contagious. Peer contagion, the influence of peer's behaviors causing changes in an individual's behaviors, could affect eating, physical activity habits and other health related behaviors (Sawka et al., 2015). The research methods of this study looked specifically at social networks to get a better understanding of who adolescents were eating with and if those same people were ones that adolescents share intimate details of their lives with. Cohesion develops during the sharing of intimate life details, but with different levels of strength. A best friend's intake of vegetables has been documented to have a positive influence on an adolescent's vegetable intake (Sawka et al., 20150), however this is weak cohesion. As previously defined, weak cohesion is eating and sharing intimate life details of life with only one person. It was found that moderate cohesion has a negative impact on dietary intake in this study therefore it would be beneficial for additional research to distinguish the influence of strong and moderate cohesion on dietary outcomes.

This study assessed the relationship between social networks and dietary outcomes among rural adolescents in Kentucky and North Carolina. Improved dietary choices promoted by influential people within an adolescent's social network can lead to a more balanced diet, healthful weight and prevention of chronic diseases. This study shows that the influence of friends regarding dietary habits causes a negative impact on dietary outcomes, however the influence of shopping with a parent or alone has some

positive findings. In addition, the stronger the cohesion within a social network, the more opportunity there is for influential dietary decision making by adolescents.

Limitations

Limitations should always be considered. This study used a cross-sectional design which is known to limit interpretation of causality. All responses were completed and self-reported by the adolescents themselves which at the age of 15-16 years old can be considered reliable, however this is recommended with short recalls or surveys. This survey was 30-40 minutes long. Adolescents took the survey among their peers therefore bias has to be considered. The sample size was large, however the population was 62% of the white race therefore not representative of all rural populations. The sample size also only looks at seven rural schools in two states.

Implications

It is hard to determine from the results specifically how dense each adolescent's social network was with friends compared to parents. It can however be reported that there were negative findings related to increased added sugar and sugar sweetened beverage consumption with both. The stronger the connectivity within an adolescent social network, the increased the opportunity for negative dietary choices to be made. Additionally, there were positive findings suggesting that adolescents who shop alone make healthier choices compared to those who shop with friends or parents.

Recommendations for Future Studies

Future research should divulge further into the findings of this study. Social networks have an effect on adolescent dietary outcomes and specifically the

relationships within these networks. Specifically, more studies should be conducted to look at the impact of a dense social network of friends on dietary outcomes in an adolescent diet. It would be beneficial to also determine if the reported friends within these social networks are also siblings, cousins, etc. Also, future studies should consider additional food shopping venues, as well as look at urban populations against rural populations to determine if geographic location plays a role in the relationship between shopping companionship and dietary outcomes. It would also be beneficial to conduct a similar study using a shorter survey which might grasp adolescent's attention for a brief, yet focused, period of time. Additionally, it may be beneficial to add key questions to measure if students are actually reading the questions thoroughly or if they are just rushing through the survey.

Appendix A

Please indicate if you shop or purchase food at these locations and with whom you shop (choose all that apply):	**Friends**	**Parents**	**Alone**
School cafeteria			
School vending			
School fundraiser			
Gas station or Convenience Store			
Fast-food restaurant (like McDonald's)			
Sit-down restaurant (like Applebee's)			
Dollar Store			
Farmers' market			
Super market (like Kroger or Sav-A-Lot)			
Super center (like Walmart)			

Appendix B

SOCIAL NETWORKING

Which of your friends do you tend to eat food with? (give their first and last name and the grade they are in)

1. First Name: _____ Last Name:_____ Grade: _____
2. First Name: _____ Last Name:_____ Grade: _____
3. First Name: _____ Last Name:_____ Grade: _____
4. First Name: _____ Last Name:_____ Grade: _____

Of these people listed which ones do you tend to buy food with whether to eat now or later?

1. First Name: _____ Last Name:_____ Grade: _____
2. First Name: _____ Last Name:_____ Grade: _____
3. First Name: _____ Last Name:_____ Grade: _____
4. First Name: _____ Last Name:_____ Grade: _____

Of the friends listed which ones do you share lots of information about your life with? Examples are when you are upset with your family, if you do poorly on a test.

1. First Name: _____ Last Name:_____ Grade: _____
2. First Name: _____ Last Name:_____ Grade: _____
3. First Name: _____ Last Name:_____ Grade: _____
4. First Name: _____ Last Name:_____ Grade: _____

References:

1. Bahr DB, Browning RC, Wyatt HR, Hill JO (2009) Exploiting social networks to mitigate the obesity epidemic. Obesity (Silver Spring) 17: 723–728.
2. Bardach, S. H., Tarasenko, Y. N., & Schoenberg, N. E. (2011). The role of social support in multiple morbidity: self-management among rural residents. *J Health Care Poor Underserved, 22*(3), 756-771. doi:10.1353/hpu.2011.0083
3. Bardenhagen, C. J., Pinard, C. A., Pirog, R., & Yaroch, A. L. (2017). Characterizing Rural Food Access in Remote Areas. *J Community Health*. doi:10.1007/s10900-017-0348-1
4. Bauer, K. W., Larson, N. I., Nelson, M. C., Story, M., & Neumark-Sztainer, D. (2009). Socio-environmental, personal and behavioural predictors of fast-food intake among adolescents. *Public Health Nutr, 12*(10), 1767-1774. doi:10.1017/S1368980008004394
5. Bevelander, K. E., Anschutz, D. J., & Engels, R. C. (2011). Social modeling of food purchases at supermarkets in teenage girls. *Appetite, 57*(1), 99-104. doi:10.1016/j.appet.2011.04.005
6. Black, C., Ntani, G., Inskip, H., Cooper, C., Cummins, S., Moon, G., & Baird, J. (2014). Measuring the healthfulness of food retail stores: variations by store type and neighbourhood deprivation. *Int J Behav Nutr Phys Act, 11*, 69. doi:10.1186/1479-5868-11-69
7. Briefel, R. R., Wilson, A., & Gleason, P. M. (2009). Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. *J Am Diet Assoc, 109*(2 Suppl), S79-90. doi:10.1016/j.jada.2008.10.064
8. Bruening, M., Eisenberg, M., MacLehose, R., Nanney, M. S., Story, M., & Neumark-Sztainer, D. (2012). Relationship between adolescents' and their friends' eating behaviors: breakfast, fruit, vegetable, whole-grain, and dairy intake. *J Acad Nutr Diet, 112*(10), 1608-1613. doi:10.1016/j.jand.2012.07.008
9. Centers for Disease Control and Prevention. (2014). *Childhood Obesity Facts*. Retreived 3/11/2017 from http://www.cdc.gov/obesity/dta/childhood.html.
10. Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. The New England journal of medicine. 2007;357(4):370-9.
11. Conger, J. C., Conger, A. J., Costanzo, P. R., Wright, K. L. & Matter, J. A. (1980) The effect of social cues on the eating behavior of obese and normal subjects. Journal of Personality, 48, 258-271.
12. Crooks, D. L. (2000). Food consumption, activity, and overweight among elementary school children in an Appalachian Kentucky community. American Journal of Physical Anthropology, 112, 159–170.
13. Cruwys, T., Bevelander, K. E., & Hermans, R. C. (2015). Social modeling of eating: a review of when and why social influence affects food intake and choice. *Appetite, 86*, 3-18. doi:10.1016/j.appet.2014.08.035
14. Davis, A. M., Bennett, K. J., Befort, C., & Nollen, N. (2011). Obesity and related health behaviors among urban and rural children in the United States: data from

the National Health And Nutrition Examination Survey 2003-2004 and 2005-2006. *J Pediatr Psychol, 36*(6), 669-676. doi:10.1093/jpepsy/jsq117
15. Davis, E. M., Cullen, K. W., Watson, K. B., Konarik, M., & Radcliffe, J. (2009). A Fresh Fruit and Vegetable Program improves high school students' consumption of fresh produce. *J Am Diet Assoc, 109*(7), 1227-1231. doi:10.1016/j.jada.2009.04.017
16. de Castro, J. M. (1990). Social facilitation of duration and size but not rate of the spontaneous meal intake of humans. *Physiology & Behavior*, *47*, 1129–1135.
17. de Castro, J. M., & de Castro, E. S. (1989). Spontaneous meal patterns in humans: Influence of the presence of other people. *American Journal of Clinical Nutrition*, *50*, 237–247.
18. Dietary Guidelines for Americans 2015–2020 8th Edition. (n.d.). Retrieved May 10, 2017, from http://health.gov/dietaryguidelines/2015/guidelines/
19. Evans, A. E., Weiss, S. R., Meath, K. J., Chow, S., Vandewater, E. A., & Ness, R. B. (2016). Adolescents' awareness and use of menu labels in eating establishments: results from a focus group study. *Public Health Nutr, 19*(5), 830-840. doi:10.1017/S1368980015001044
20. Flatt JD, Agimi Y, Albert SM. Homophily and health behavior in social networks of older adults. Family & community health. 2012;35(4):312-21.
21. Fletcher A, Bonell C, Sorhaindo A (2011) You are what your friends eat: systematic review of social network analyses of young people's eating behaviours and bodyweight. J Epidemiol Community Health 65: 548–555.
22. Feunekes, G.I., de Graaf, C., Meyboom, S., van Staveren, W.A., 1998. Food choices and fat intake of adolescents and adults: associations of intakes within social networks. Preventative Medicine 27, 645–656.
23. Gittelsohn, J., Song, H. J., Suratkar, S., Kumar, M. B., Henry, E. G., Sharma, S., . . . Anliker, J. A. (2010). An urban food store intervention positively affects food-related psychosocial variables and food behaviors. *Health Educ Behav, 37*(3), 390-402. doi:10.1177/1090198109343886
24. Goldman, S. J., Herman, C. P., & Polivy, J. (1991). Is the effect of a social model on eating attenuated by hunger? *Appetite, 17*(2), 129-140.
25. Gustafson, A., Christian, J. W., Lewis, S., Moore, K., & Jilcott, S. (2013). Food venue choice, consumer food environment, but not food venue availability within daily travel patterns are associated with dietary intake among adults, Lexington Kentucky 2011. *Nutr J, 12*, 17. doi:10.1186/1475-2891-12-17
26. Gustafson A., Wu Q, Spees C, Putnam N, Adams I, et al. (2014) How Adolescents and Parents Food Shopping Patterns and Social Interaction when Shopping is Associated with Dietary Outcomes in Rural Communities. J Obes Weight Loss Ther 4: 214. doi:10.4172/2165- 7904.1000214
27. Herman, C. P. (2017). The social facilitation of eating or the facilitation of social eating? *J Eat Disord, 5*, 16. doi:10.1186/s40337-017-0146-2
28. Herman, C. P., & Polivy, J. (2005). Normative influences on food intake. *Physiology & Behavior*, *86*, 762–772.
29. Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others

on food intake: a normative interpretation. *Psychol Bull, 129*(6), 873-886. doi:10.1037/0033-2909.129.6.873
30. Higgs, S. and Thomas, J. Social influences on eating, Current Opinion in Behavioral Sciences, Volume 9, 2016, Pages 1-6, ISSN 2352-1546, http://dx.doi.org/10.1016/j.cobeha.2015.10.005.
31. Larsen, J. K., Hermans, R. C., Sleddens, E. F., Engels, R. C., Fisher, J. O., & Kremers, S. P. (2015). How parental dietary behavior and food parenting practices affect children's dietary behavior. Interacting sources of influence? *Appetite, 89*, 246-257. doi:10.1016/j.appet.2015.02.012
32. Larson, N., Neumark-Sztainer, D., Laska, M. N., & Story, M. (2011). Young adults and eating away from home: associations with dietary intake patterns and weight status differ by choice of restaurant. *J Am Diet Assoc, 111*(11), 1696-1703. doi:10.1016/j.jada.2011.08.007
33. Larson, N. I., Story, M., Eisenberg, M. E., & Neumark-Sztainer, D. (2006). Food preparation and purchasing roles among adolescents: associations with sociodemographic characteristics and diet quality. *J Am Diet Assoc, 106*(2), 211-218. doi:10.1016/j.jada.2005.10.029
34. Liu JH, Jones SJ, Sun H, Probst JC, Merchant AT, Cavicchia P. Diet, physical activity, and sedentary behaviors as risk factors for child- hood obesity: An urban and rural comparison. Child Obes. 2012;8(5): 440-448.
35. Lorson, B. A., Melgar-Quinonez, H. R., & Taylor, C. A. (2009). Correlates of fruit and vegetable intakes in US children. *J Am Diet Assoc, 109*(3), 474-478. doi:10.1016/j.jada.2008.11.022
36. Marshall, T. A., Van Buren, J. M., Warren, J. J., Cavanaugh, J. E., & Levy, S. M. (2017). Beverage Consumption Patterns at Age 13 to 17 Years Are Associated with Weight, Height, and Body Mass Index at Age 17 Years. *J Acad Nutr Diet*. doi:10.1016/j.jand.2017.01.010
37. Maximova, K., McGrath, J. J., Barnett, T., O'Loughlin, J., Paradis, G., & Lambert, M. (2008). Do you see what I see? Weight status misperception and exposure to obesity among children and adolescents. *Int J Obes (Lond), 32*(6), 1008-1015. doi:10.1038/ijo.2008.15
38. McCormack, L. A., & Meendering, J. (2016). Diet and Physical Activity in Rural vs Urban Children and Adolescents in the United States: A Narrative Review. *J Acad Nutr Diet, 116*(3), 467-480. doi:10.1016/j.jand.2015.10.024
39. Miller, W. C., Hering, M., Cothran, C., Croteau, K., & Dunlap, R. (2012). After-school physical activity and eating behaviors of middle school students in relation to adult supervision. *J Nutr Educ Behav, 44*(4), 326-334. doi:10.1016/j.jneb.2011.08.002
40. Nickelson, J., Roseman, M. G., & Forthofer, M. S. (2010). Associations between parental limits, school vending machine purchases, and soft drink consumption among Kentucky middle school students. *J Nutr Educ Behav, 42*(2), 115-122. doi:10.1016/j.jneb.2009.02.005
41. O'Dougherty, M., Story, M., & Stang, J. (2006). Observations of parent-child co-shoppers in supermarkets: children's involvement in food selections, parental

yielding, and refusal strategies. *J Nutr Educ Behav, 38*(3), 183-188. doi:10.1016/j.jneb.2005.11.034
42. Ogden, C. L., Carroll, M. D., Lawman, H. G., Fryar, C. D., Kruszon-Moran, D., Kit, B. K., & Flegal, K. M. (2016). Trends in Obesity Prevalence Among Children and Adolescents in the United States, 1988-1994 Through 2013-2014. *JAMA, 315*(21), 2292-2299. doi:10.1001/jama.2016.6361
43. Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA, 295*(13), 1549-1555. doi:10.1001/jama.295.13.1549
44. Patel, K. A., & Schlundt, D. G. (2001). Impact of moods and social context on eating behavior. *Appetite, 36*, 111–118.
45. Robinson E, Tobias T, Shaw L, Freeman E, Higgs S: Social matching of food intake and the need for social acceptance. Appetite 2011, 56:747-752.
46. Salvy, S. J., de la Haye, K., Bowker, J. C., & Hermans, R. C. (2012). Influence of peers and friends on children's and adolescents' eating and activity behaviors. *Physiol Behav, 106*(3), 369-378. doi:10.1016/j.physbeh.2012.03.022
47. Salvy, S. J., Elmo, A., Nitecki, L. A., Kluczynski, M. A., & Roemmich, J. N. (2011). Influence of parents and friends on children's and adolescents' food intake and food selection. *Am J Clin Nutr, 93*(1), 87-92. doi:10.3945/ajcn.110.002097
48. Salvy SJ1, Kluczynski MA, Nitecki LA, O'Connor BC (2012) Peer influence on youth's snack purchases: a laboratory analog of convenience store shopping. Eat Behav 13: 233-239.
49. Sawka, K. J., McCormack, G. R., Nettel-Aguirre, A., & Swanson, K. (2015). Associations between aspects of friendship networks and dietary behavior in youth: Findings from a systematized review. *Eat Behav, 18*, 7-15. doi:10.1016/j.eatbeh.2015.03.002
50. Singh, G. K., Kogan, M. D., & van Dyck, P.,C. (2008). A multilevel analysis of state and regional disparities in childhood and adolescent obesity in the united states. *Journal of Community Health, 33*(2), 90-102. doi:http://dx.doi.org.ezproxy.uky.edu/10.1007/s10900-007-9071-7
51. Shin, A., Surkan, P. J., Coutinho, A. J., Suratkar, S. R., Campbell, R. K., Rowan, M., . . . Gittelsohn, J. (2015). Impact of Baltimore Healthy Eating Zones: an environmental intervention to improve diet among African American youth. Health Educ Behav, 42(1 Suppl), 97S-105S. doi:10.1177/1090198115571362
52. Shoham DA, Tong L, Lamberson PJ, Auchincloss AH, Zhang J, Dugas L, et al. An actor-based model of social network influence on adolescent body size, screen time, and playing sports. PloS one. 2012;7(6):e39795.
53. Stok, F., De Vet, E., De Wit, J., Luszczynska, A., Safron, M., & De Ridder, D. (2015). The proof is in the eating: Subjective peer norms are associated with adolescents' eating behaviour. *Public Health Nutrition, 18*(6), 1044-1051. doi:10.1017/S1368980014001268
54. Sutherland, L. A., Beavers, D. P., Kupper, L. L., Bernhardt, A. M., Heatherton, T., & Dalton, M. A. (2008). Like parent, like child: child food and beverage choices during role playing. *Arch Pediatr Adolesc Med, 162*(11), 1063-1069.

doi:10.1001/archpedi.162.11.1063
55. Thompson, F. E., McNeel, T. S., Dowling, E. C., Midthune, D., Morrissette, M., & Zeruto, C. A. (2009). Interrelationships of added sugars intake, socioeconomic status, and race/ethnicity in adults in the United States: National Health Interview Survey, 2005. *J Am Diet Assoc, 109*(8), 1376-1383. doi:10.1016/j.jada.2009.05.002
56. United States Department of Health and Human Services and the Department of Agriculture. *Dietary Guidelines for Americans*, 2005. Washington, DC: US Government Printing Office, 2005.
57. Zabinski, M. F., Daly, T., Norman, G. J., Rupp, J. W., Calfas, K. J., Sallis, J. F., & Patrick, K. (2006). Psychosocial correlates of fruit, vegetable, and dietary fat intake among adolescent boys and girls. *J Am Diet Assoc, 106*(6), 814-821. doi:10.1016/j.jada.2006.03.014

VITA

Jordan Elizabeth McDonald

Education:

- Bachelor's of Science in Nutrition and Dietetics
    - Radford University, Radford, VA, May 2014
- Master's of Science in Nutrition and Food Systems (expected)
    - University of Kentucky, Lexington, KY, December 2017

Professional Positions Held

- Clinical Dietitian, Morrison Healthcare, Lexington, KY, August 2015-Present
- Research Assistant, Department of Dietetics and Human Nutrition, University of Kentucky, Lexington, KY, August 2016-Present

Professional Memberships

- Academy of Nutrition and Dietetics
    - September 2012-Present
- Bluegrass Academy of Nutrition and Dietetics
    - September 2016-Present

Scholastic and Professional Honors

- 2014 Nutrition and Dietetics Student of the Year, Radford University